United States Department of Agriculture
Northern Forests Climate Hub

Using Tools to Integrate Considerations of Climate into Land Management




Danielle Shannon, Chris Swanston

Northern Institute of Applied Climate Science
www.forestadaptation.org

Road map

- Climate change tools and data
- Tools to help address climate change in site-level planning
- Real-world climate adaptation example




Past Management History
Invasives
Culverts, ditches, roads
Water Quality and Quantity
T&E Species
Forest Health
Disturbance: Past + Future
Plan & Project Requirements
Wildfire
Wildlife Habitat
Recreation
www.ncwetlands.org


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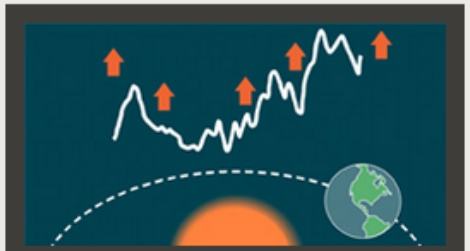
For more background on climate change

Education Modules

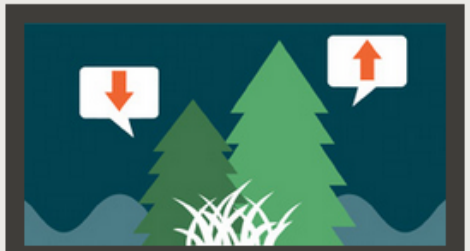
These comprehensive education modules were created using curriculum developed by the Forest Service Climate Change Advisor's Office, Climate Change Education and Training Team. They give an in-depth introduction to basic climate change science, the effects of climate change on forest and grassland ecosystems, and how we can respond to climate change with management.



Climate Change Science and Modeling

Learn about the climate system, greenhouse gases, climate models, current climate impacts, and future projections.

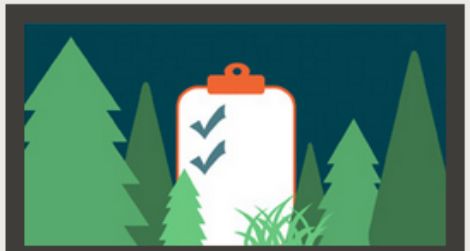
Read More >



Climate Change Effects on Forests and Grasslands

Explore current and projected climate effects on water resources, vegetation, wildlife, and disturbances for forest and grassland ecosystems.

Read More >



Responses to Climate Change

Review the adaptation options, resistance, resilience, and transition, and learn how to incorporate them into natural resource planning.

Read More >

Get a certificate of completion.

Also featured In USDA AgLearn!

www.fs.usda.gov/ccrc/education

Tools to inform a broader strategy

Climate data and tools can help us:

- **Better understand the impacts** of climate change
- **Communicate the risks** to stakeholders and communities
- **Strategically prioritize goals and actions** to protect habitat, water resources, wildlife in an uncertain future

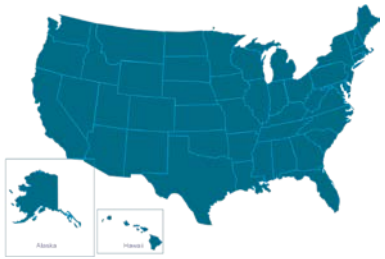
All tools have limitations and assumptions that need to be considered

Local knowledge and experience are crucial!

Tools to inform a broader strategy

Nationally available tools specific to climate change

- Observed trends and baseline historical data
- Future projections
- Various topics
- Clearinghouses of resources



Note: New tools for the toolbox!

Climate resources can compliment existing management tools used to understand ecosystems and guide planning.

***They do not replace**:*

- *Fundamentals*
- *Plant and silvicultural management guides*
- *Current land-use and vegetation information*
- *State and federal regulations*

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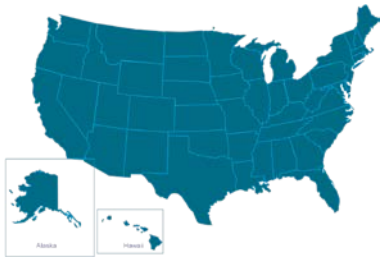

Regional climate change tools

Other topics (more than climate trends)

Specialized viewers and tools

- Vegetation, hydrology, wildlife habitat, carbon

Analysis at a finer scale

- *State, Coastal, Ecoregions, Watershed, Stream*
- *Forest-type, natural communities, habitat, wildlife species*

Note: New tools for the toolbox!

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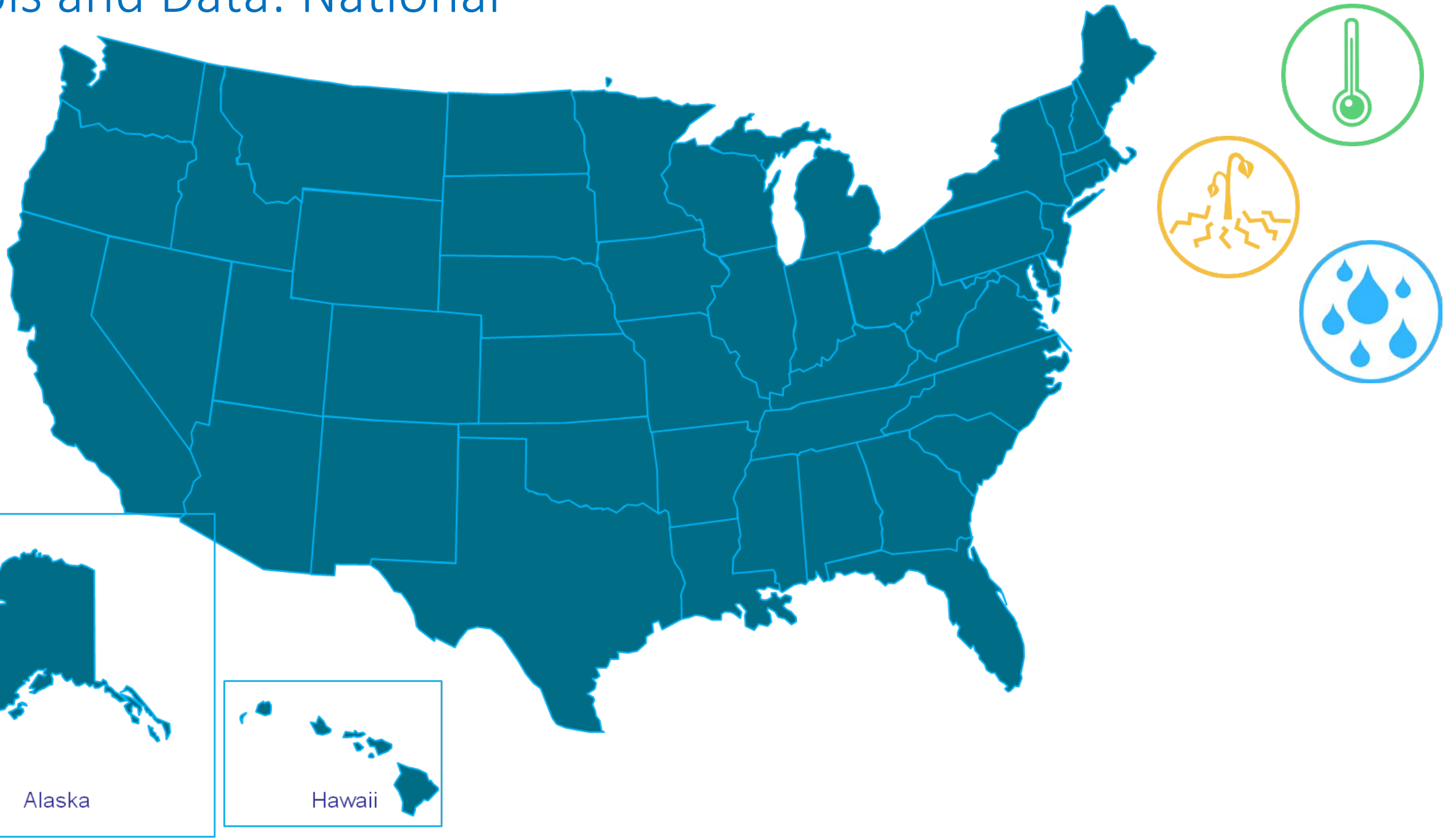
Tools and Data: National



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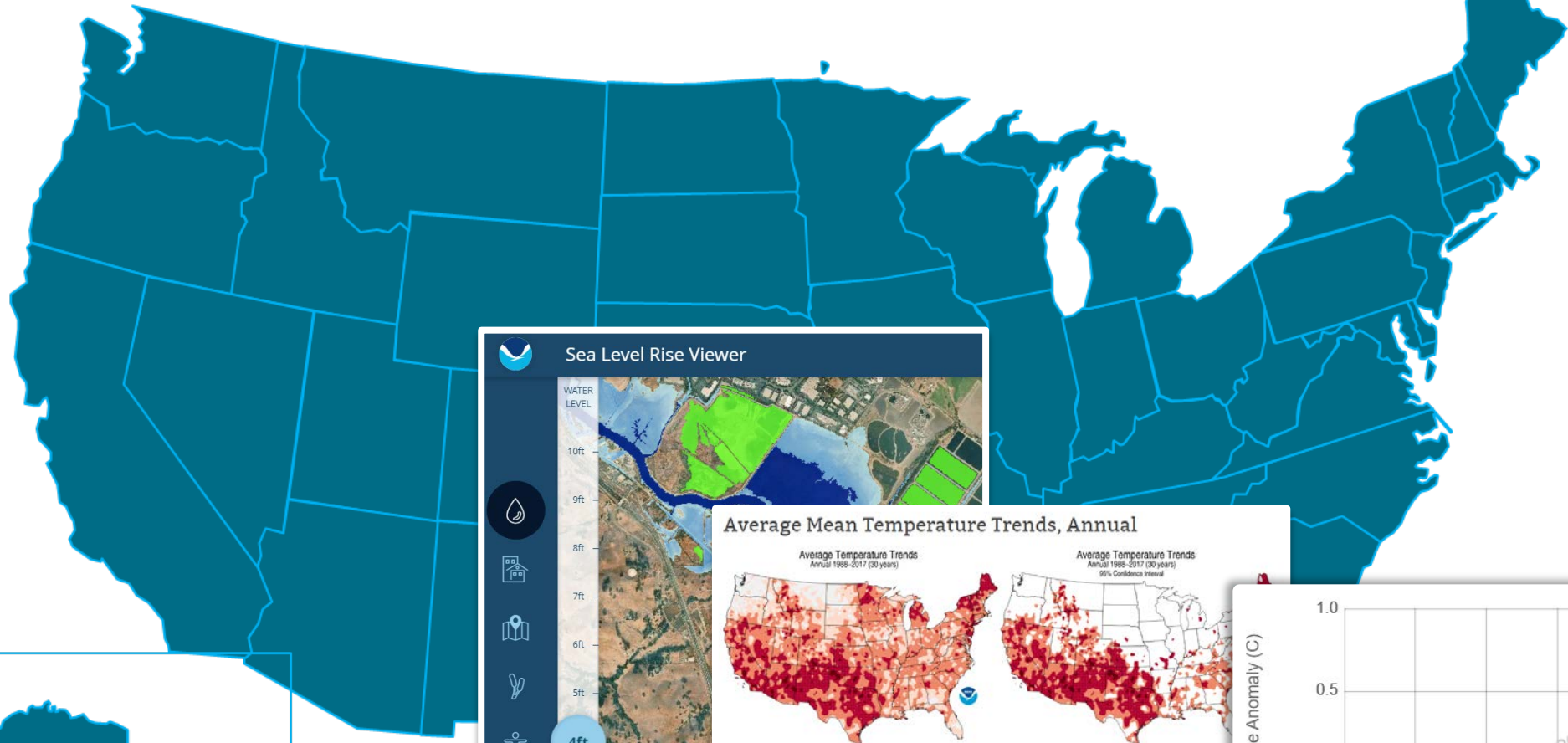
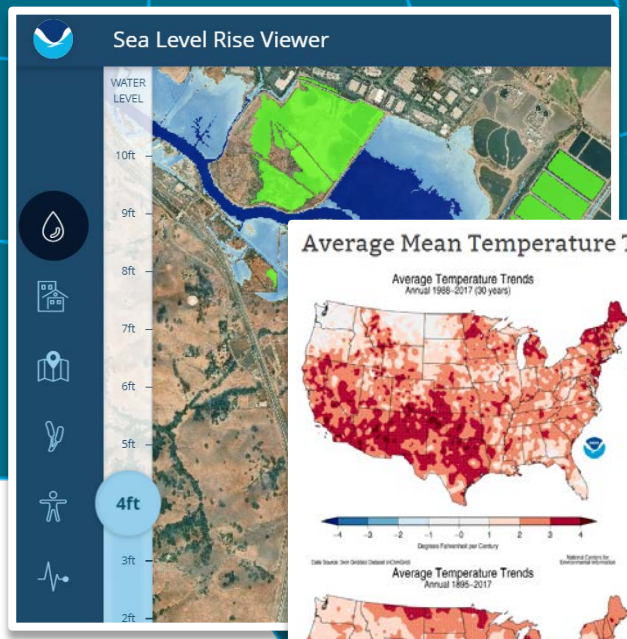
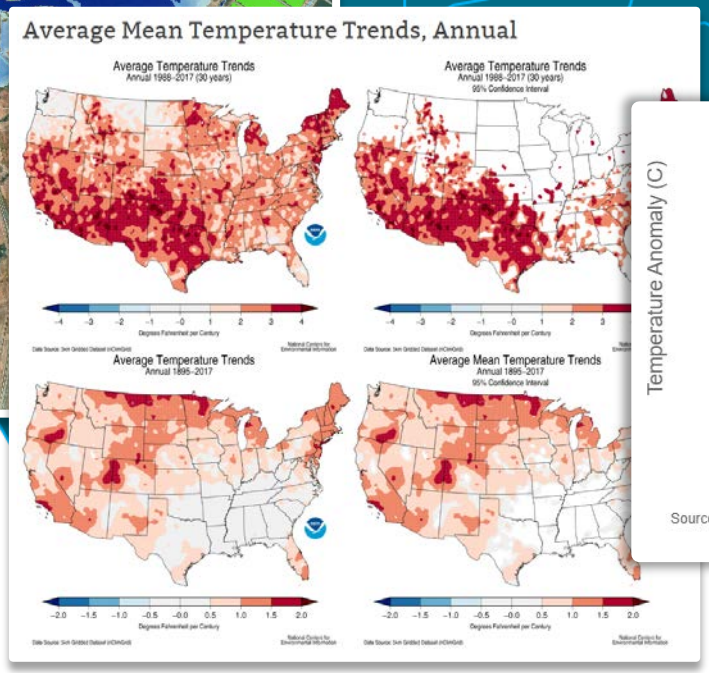
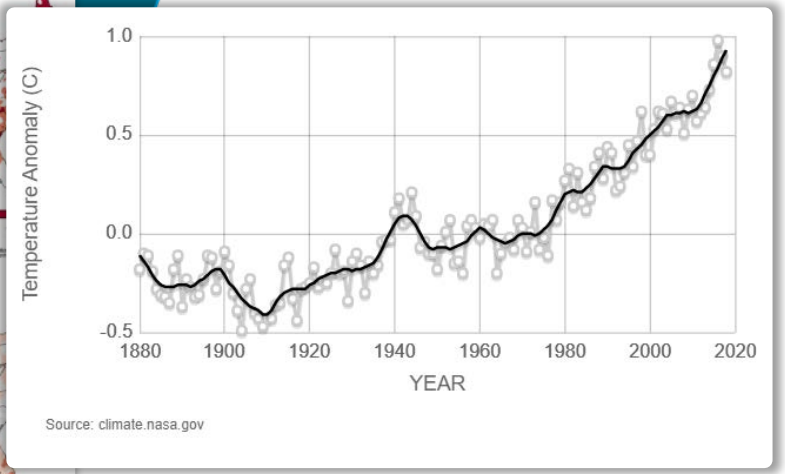
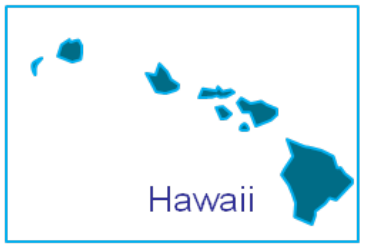








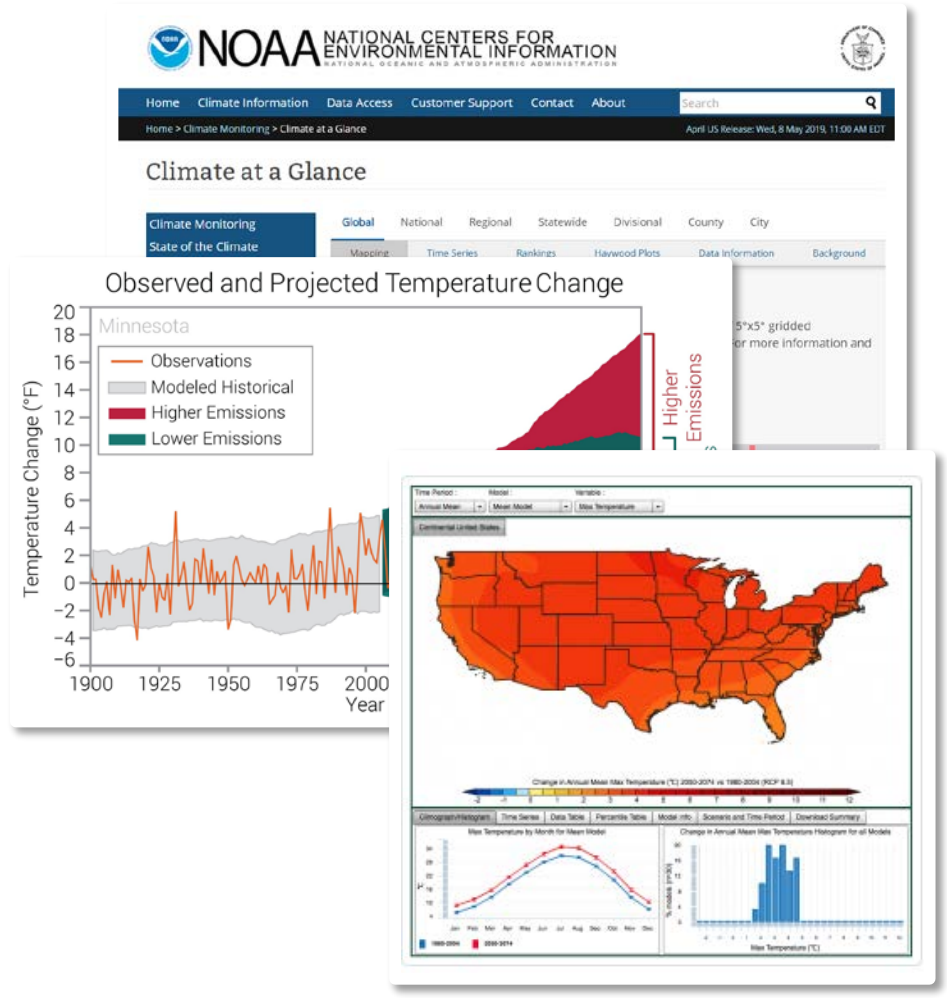


Tools and Data: National

1. Climate trends and baseline historical datasets
2. Future projections
3. Clearinghouses of resources

Data, maps, graphs: Weather and Climate

- NOAA Climate www.Climate.gov
- NOAA Climate at a Glance www.ncdc.noaa.gov/cag
- NOAA State Climate Summaries statesummaries.ncics.org
- EPA Climate Indicators www.epa.gov/climate-indicators
- USGS National Climate Change Viewer *(create reports)* www2.usgs.gov/landresources/lcs/nccv.asp
- NOAA Sea Level Rise coast.noaa.gov/slr



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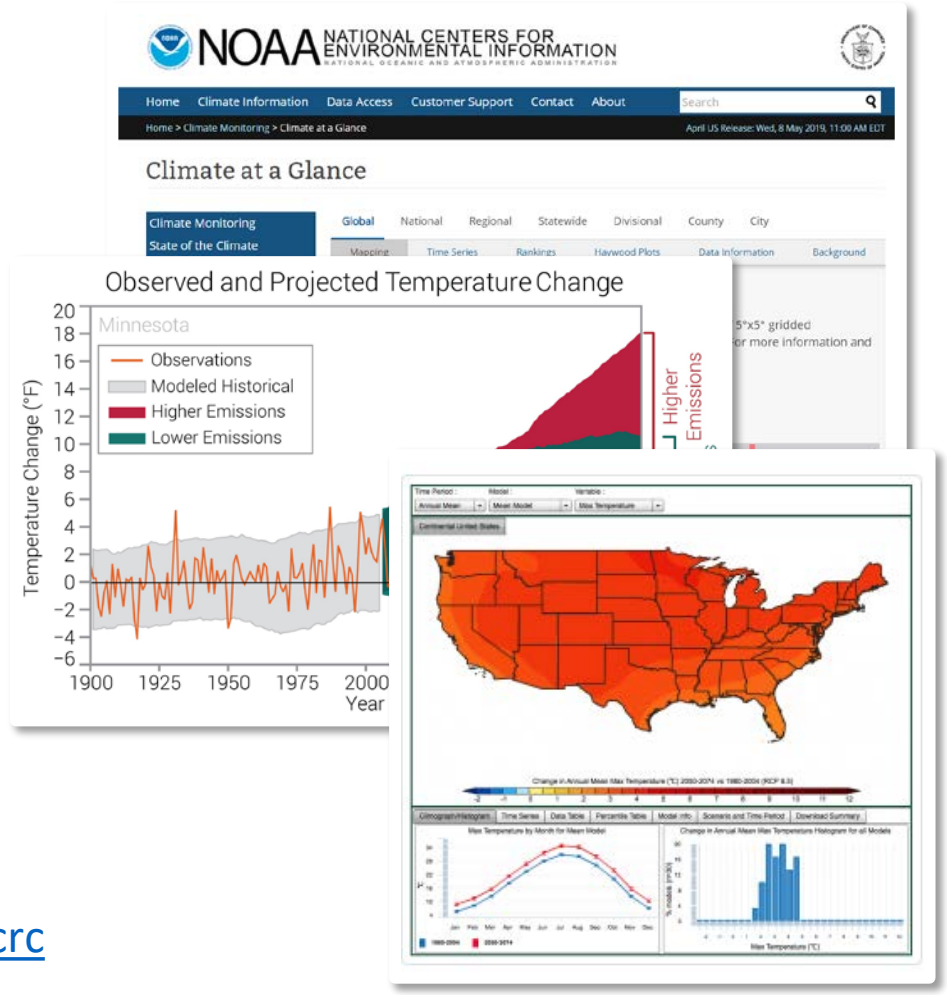
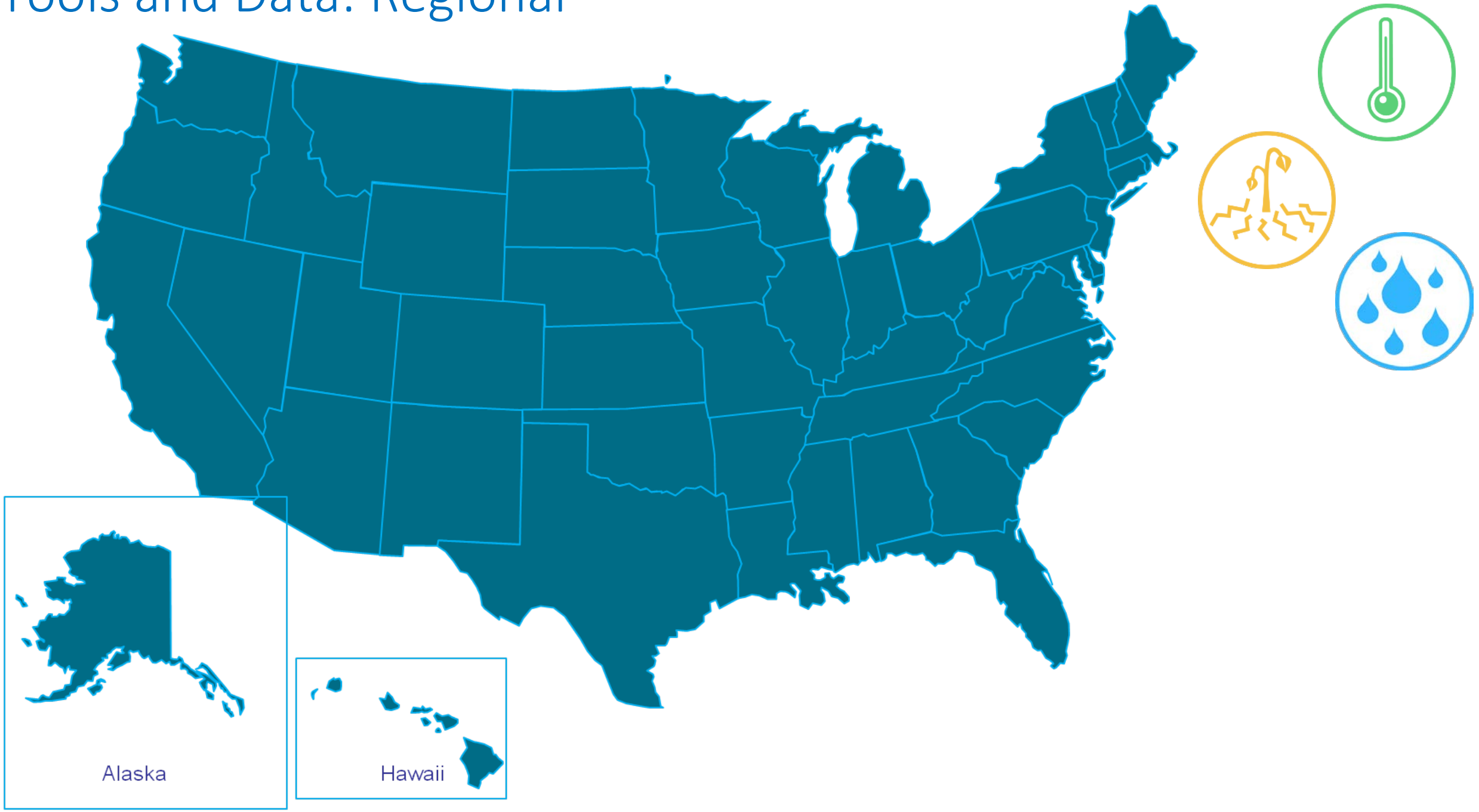


Narrative + Data (Historical, and Future Projections)

- USGCRP National Climate Assessments, Climate Science Special Report www.globalchange.gov
- USDA Forest Service Climate Change Resource Center www.fs.usda.gov/ccrc

Tools and Data: Regional



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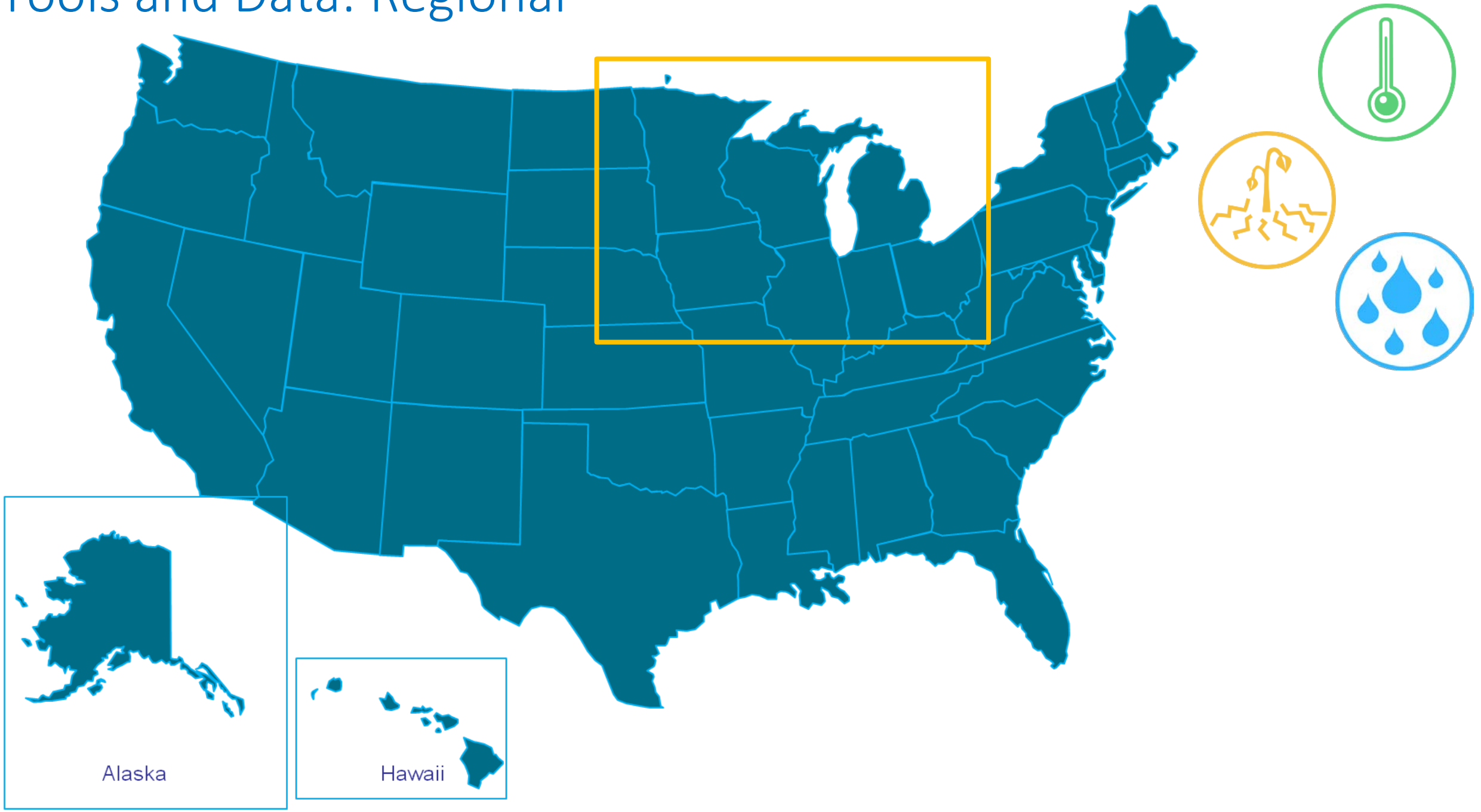

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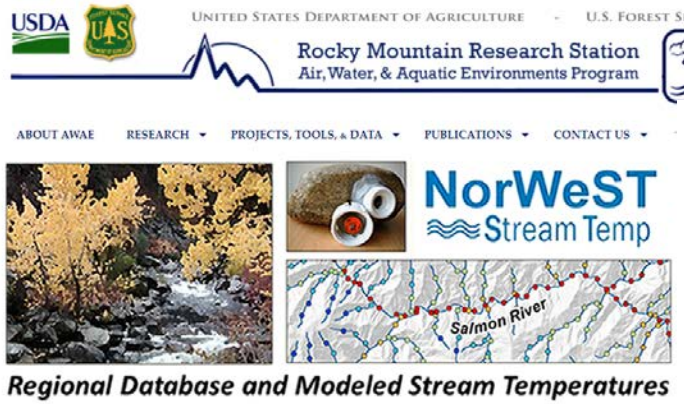

Regional Database and Modeled Stream Temperatures

USDA Forest Service Climate Change Atlas
www.fs.fed.us/nrs/atlas

Data, maps, graphs: Climate + Ecosystems

- USDA Forest Service Climate Change Resource Center www.fs.usda.gov/ccrc/topics
- USDA Forest Service Climate Gallery - https://tinyurl.com/USFSClimateGallery
- USDA Forest Service Climate Change Atlas www.fs.fed.us/nrs/atlas
- Seedlot Selection Tool seedlotselectiontool.org/sst/
- USDA Forest Service NorWeST stream temperature data and climate scenarios (Western region)
- US Climate Resilience Toolkit: Regions https://toolkit.climate.gov/#regions
- US Climate Resilience Toolkit: https://toolkit.climate.gov/tools
- The Nature Conservancy Resilient sites for Conservation – http://nature.ly/TNCResilience

Regional tools = locally relevant resources

Examples of ecosystem-based assessments of vulnerability to climate change from the Midwest and Northeast

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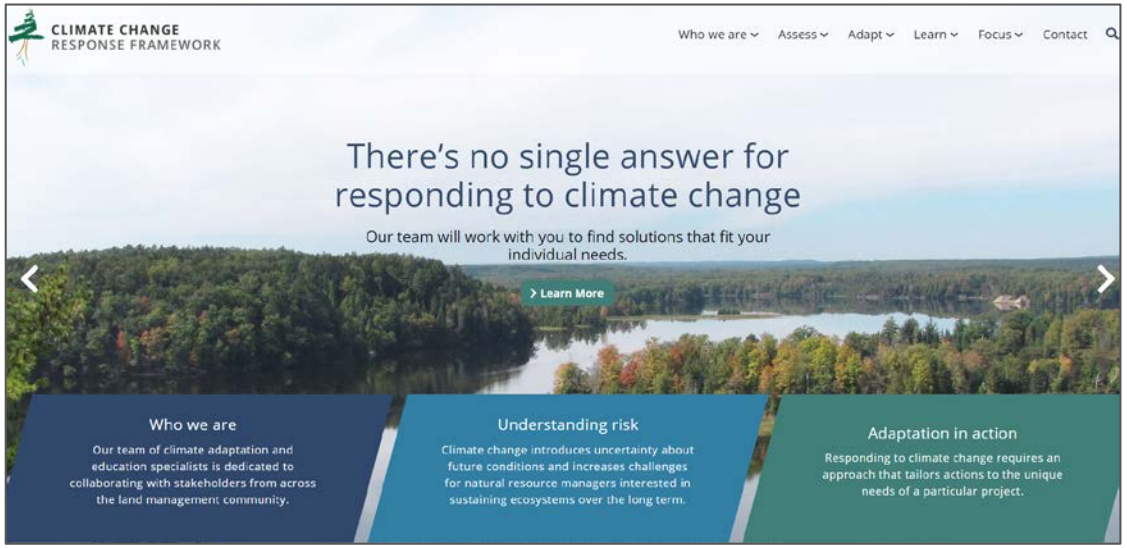

Climate Change Response Framework

forestadaptation.org

Collaborative, expert driven analysis of **regional forest-type and tree species vulnerability for ecoregions across 20 states,** and adaptation resources for a variety of topics.

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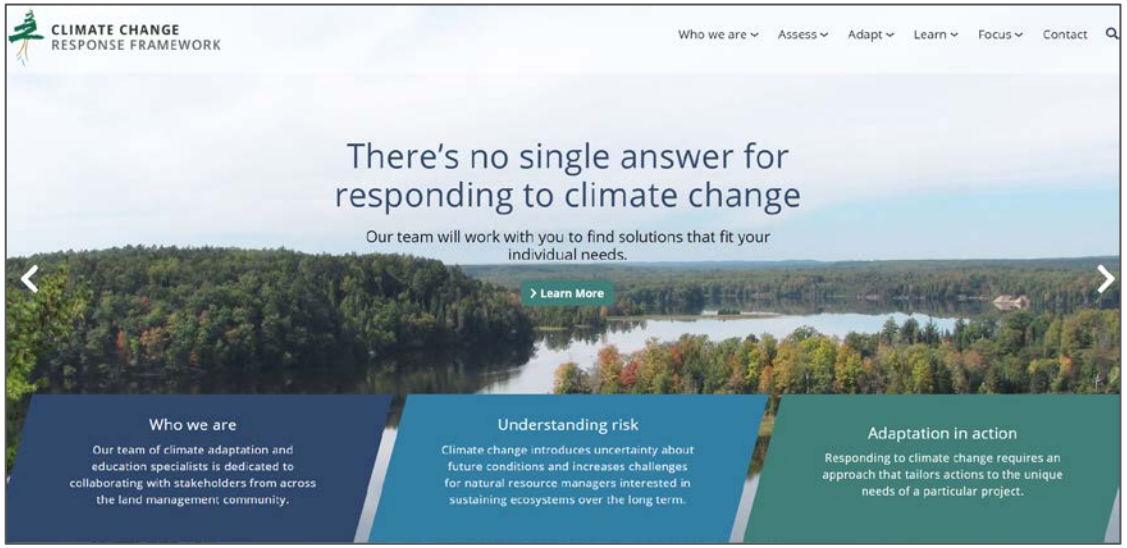
Examples of ecosystem-based assessments of vulnerability to climate change from the Midwest and Northeast



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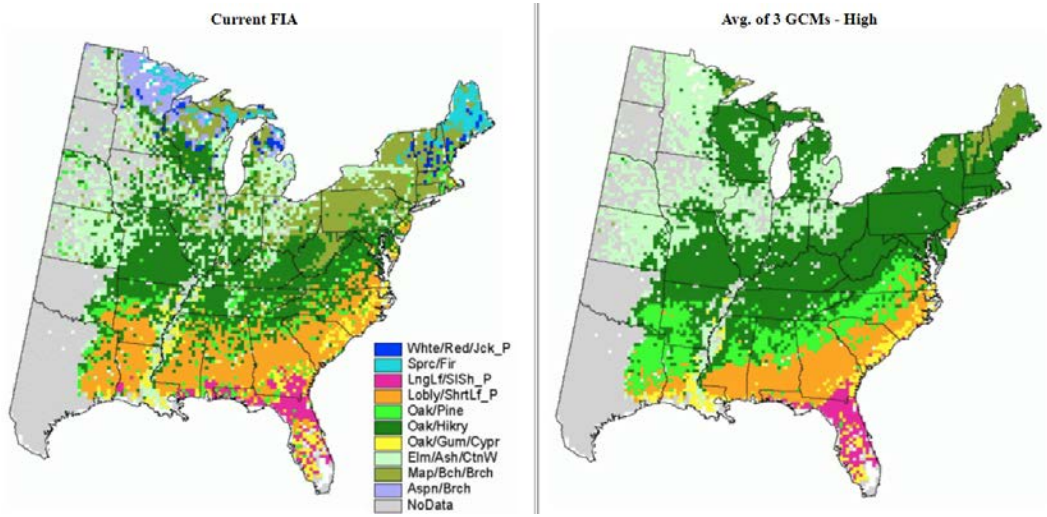
WISCONSIN INITIATIVE ON CLIMATE CHANGE IMPACTS

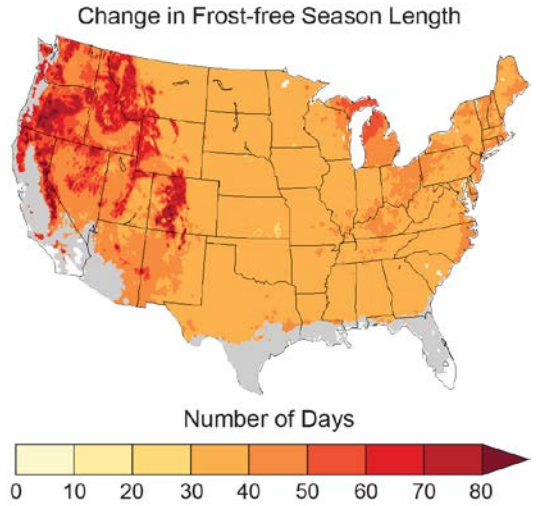
Plants and Natural Community Working Group

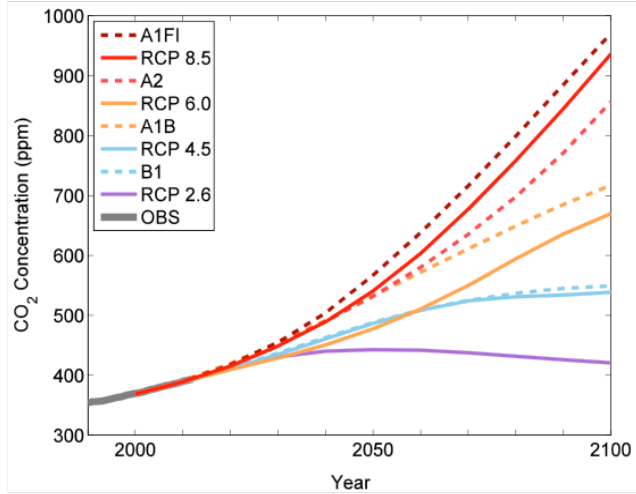
wicci.wisc.edu/plants-and-natural-communities-working-group.php

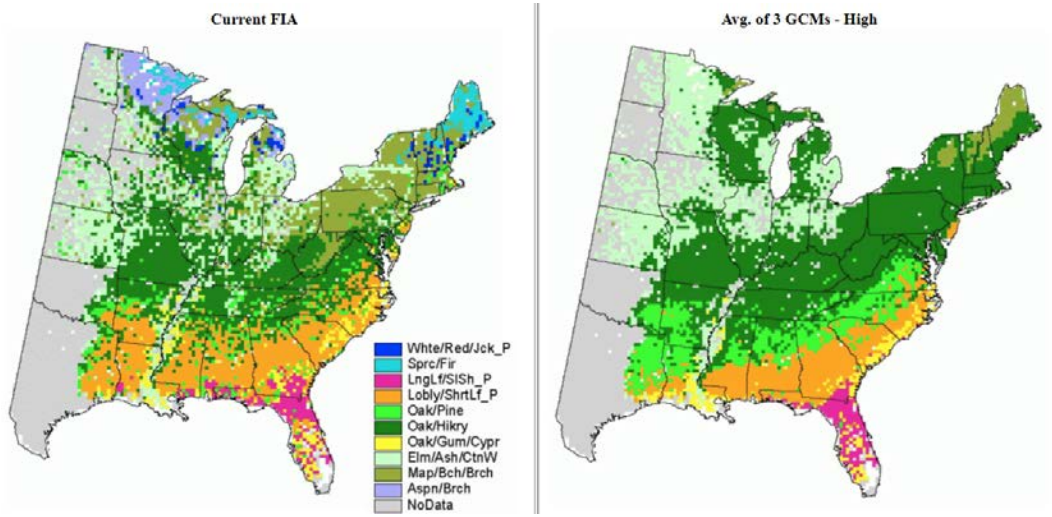
Climate change vulnerability assessments of broad and individual **plant natural community groups** in Wisconsin.


Current FIA
Wht/Red/Jck_P
Sprc/Fir
LngLf/SlSh_P
Lobly/ShrtLf_P
Oak/Pine
Oak/Hikry
Oak/Gum/Cypr
Elm/Ash/CtnW
Map/Bch/Brch
Aspn/Brch
NoData

Avg. of 3 GCMs - High


Change in Frost-free Season Length
Number of Days
0
10
20
30
40
50
60
70
80


A1FI
RCP 8.5
A2
RCP 6.0
A1B
RCP 4.5
B1
RCP 2.6
OBS
CO2 Concentration (ppm)
1000
900
800
700
600
500
400
300
2000
2050
2100
Year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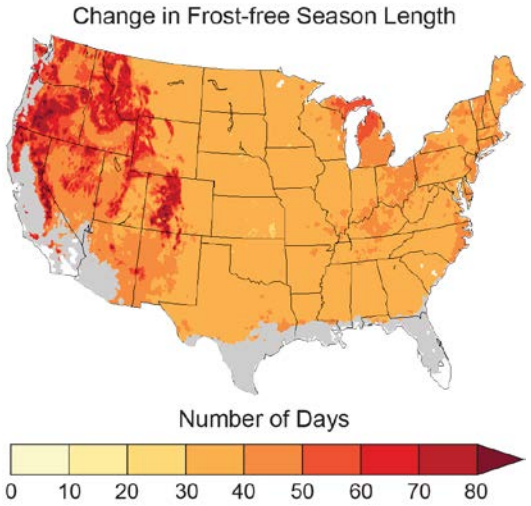
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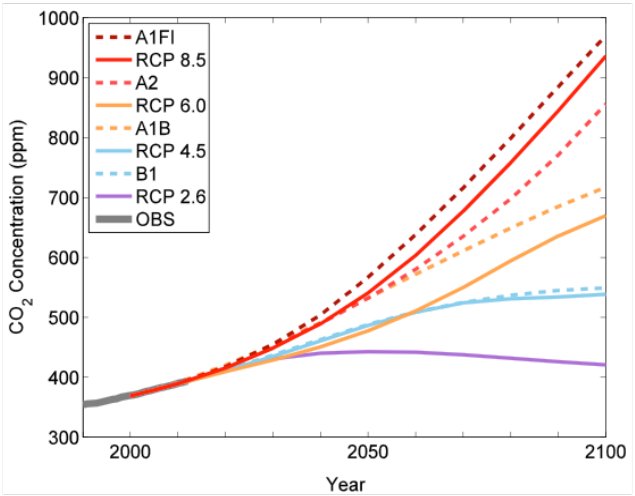
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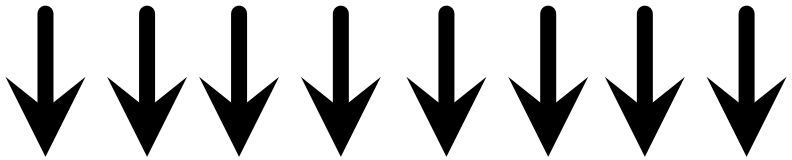
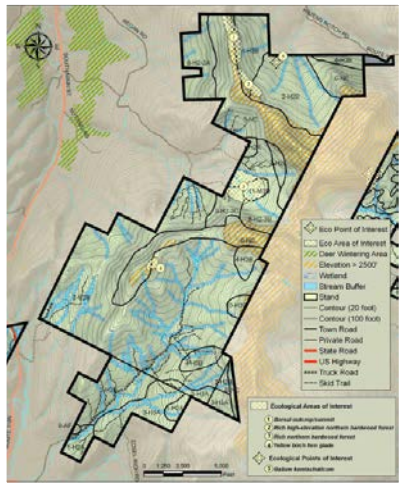




What actions can be taken to

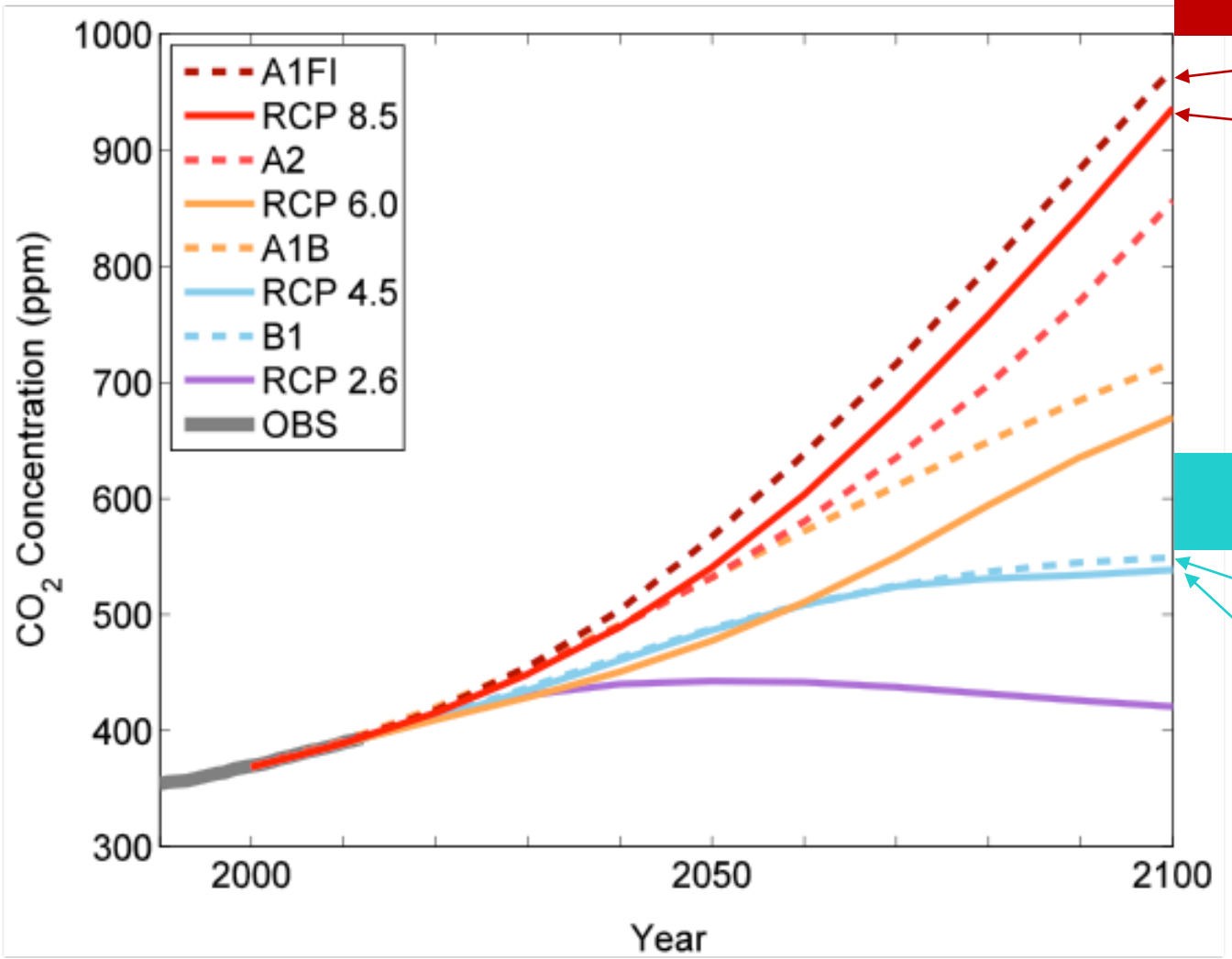
enhance the ability of a system to cope with climate change

and

meet your goals and objectives?


thinning
promoting connectivity
planting
controlling invasives
prescribed burning
intentionality

Embracing Uncertainty: Plan for a Range



"High" emissions

SRES A1FI

RCP 8.5

"Low" emissions

SRES B1

RCP 4.5

Figure Source: IPCC 2014

Options: Responding to climate change

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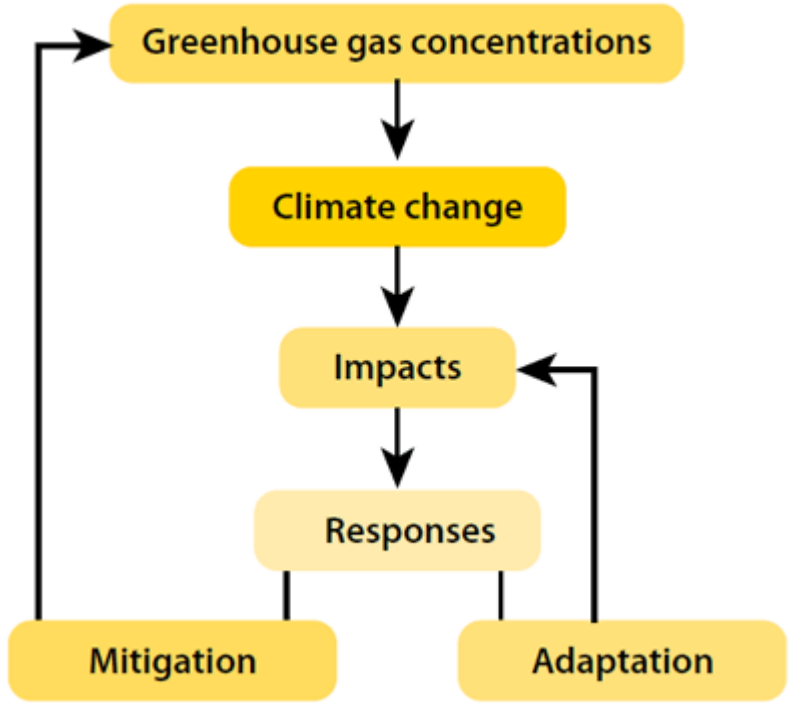
Mitigation:
Actions that reduce the human contribution to the greenhouse gas effect.



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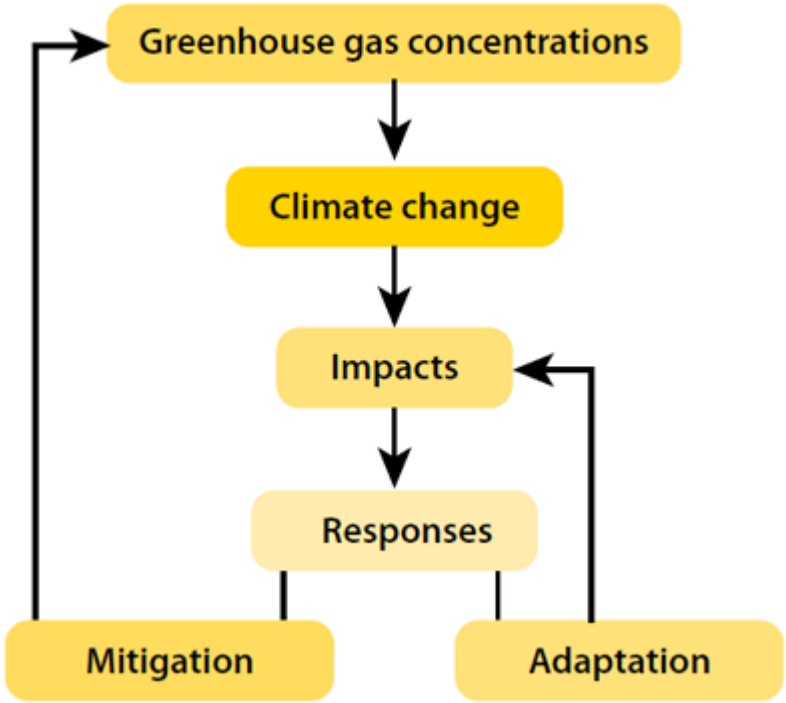


Adaptation:
Actions to prepare for and adjust to new conditions.

Adaptation is the adjustment of systems in preparation or in response to climate change.



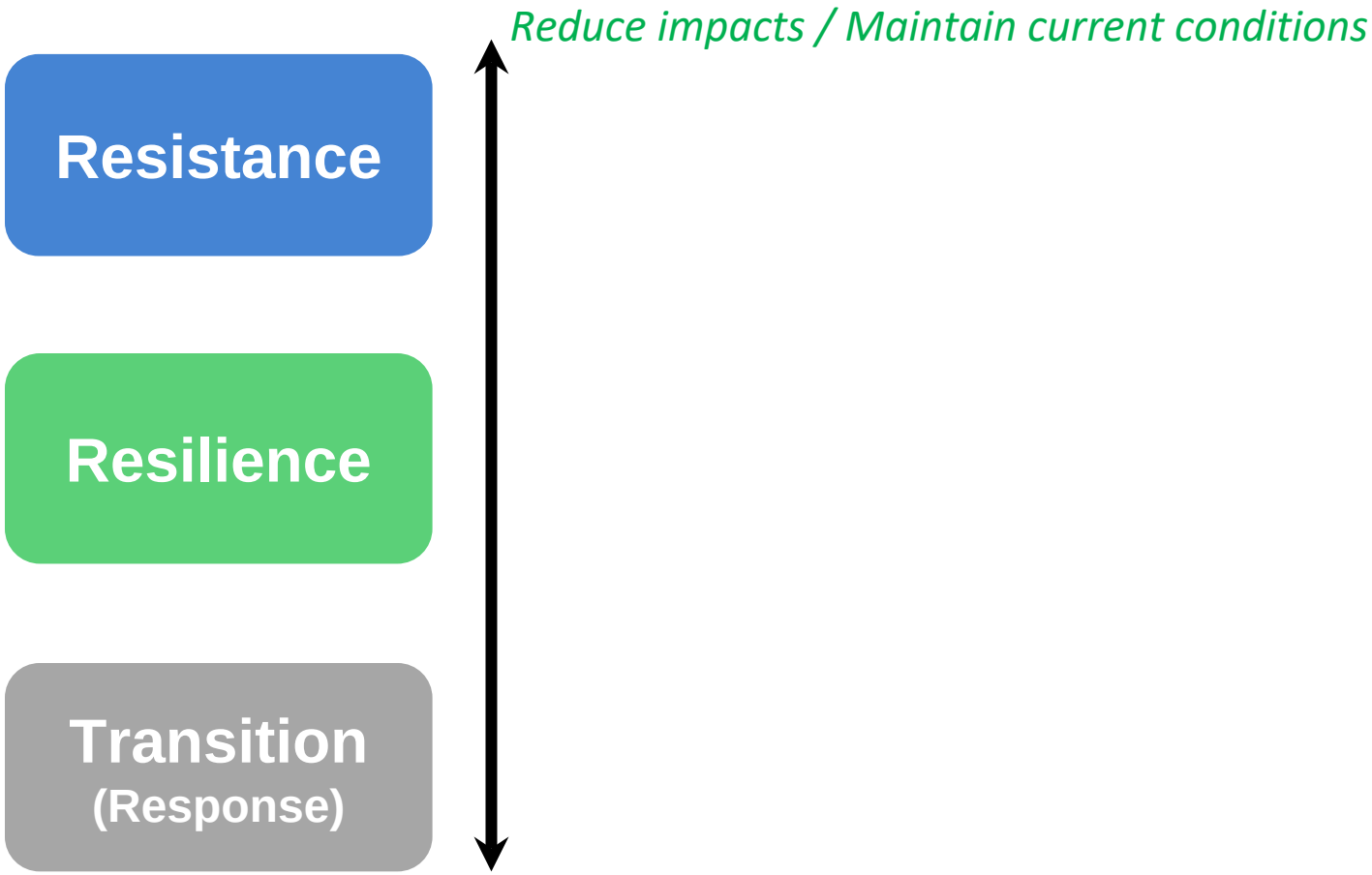

Ecosystem-based adaptation activities that build on sustainable management, conservation, and restoration.

Adaptation is the adjustment of systems in preparation or in response to climate change.



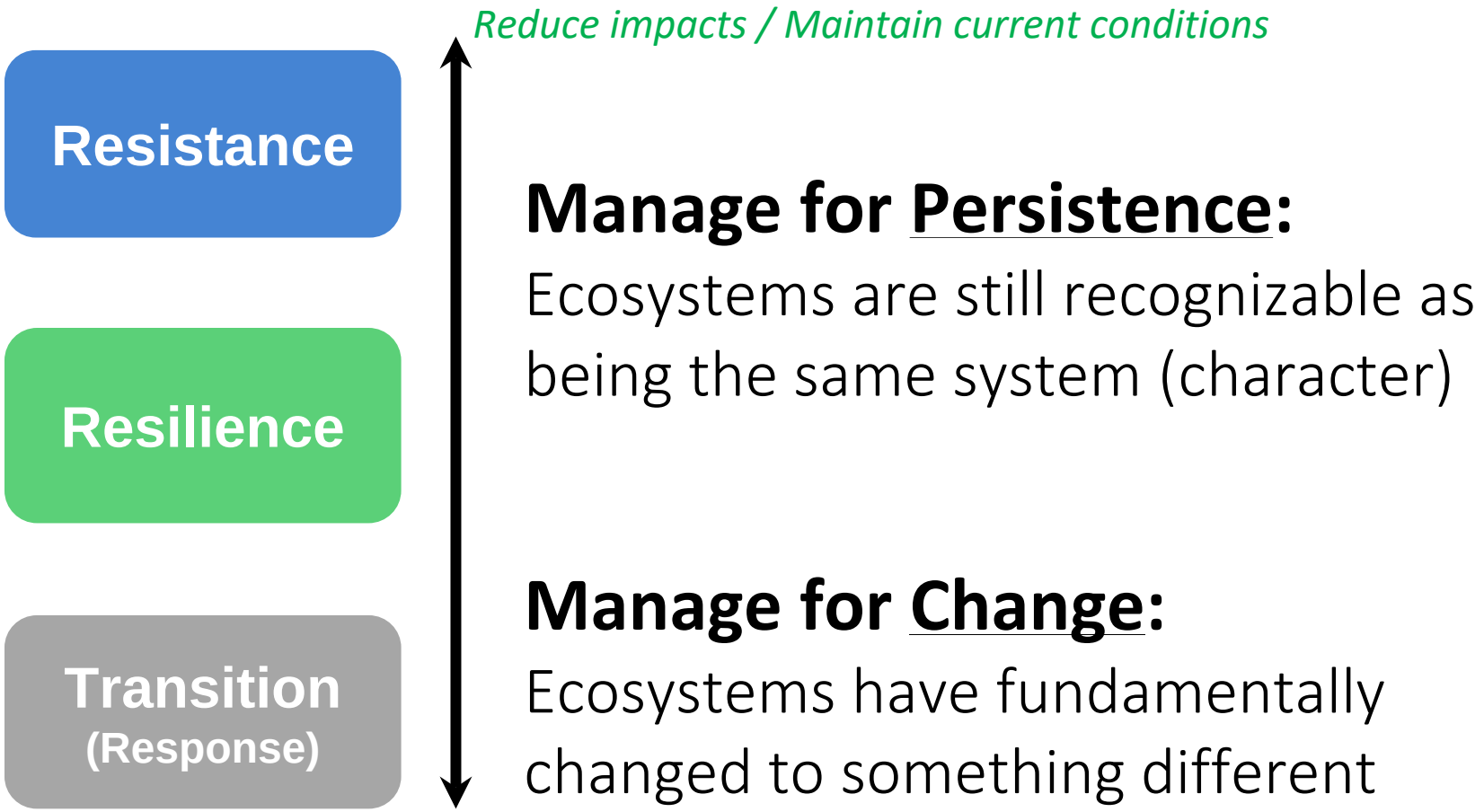

- What do you value?
- How much risk are you willing to tolerate?

Adaptation Concepts



Millar et al. 2007, Stein et al. 2014

Adaptation Concepts



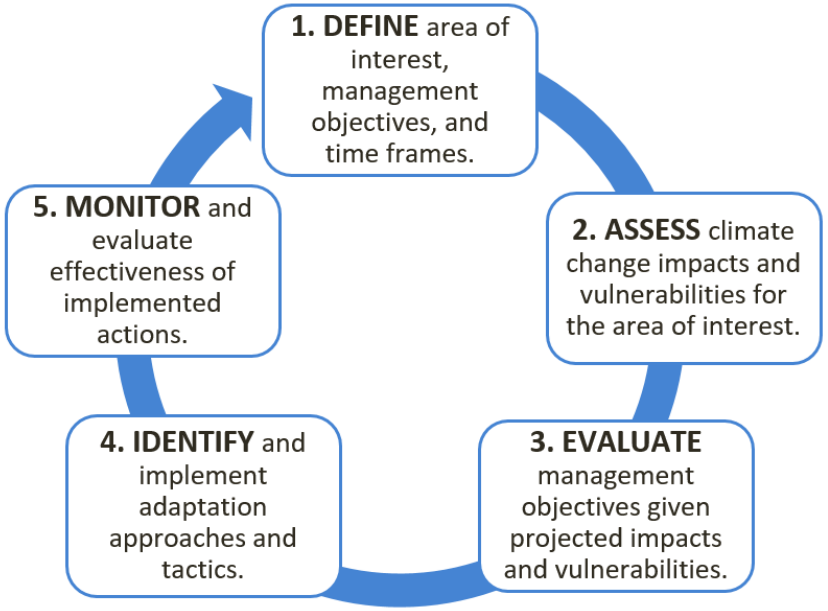
Millar et al. 2007, Stein et al. 2014

Tools to help managers adapt

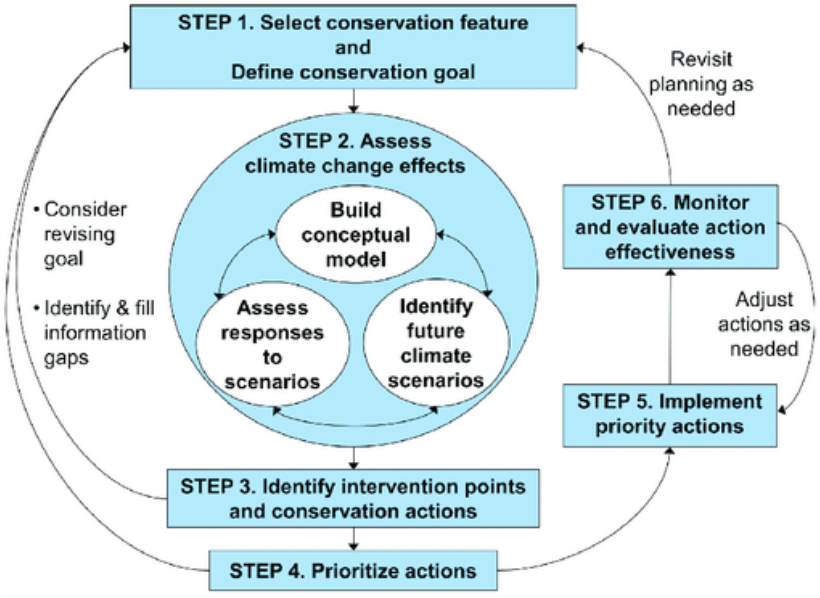
There are many processes to explicitly consider climate change in land planning.

Use a process that works for you.

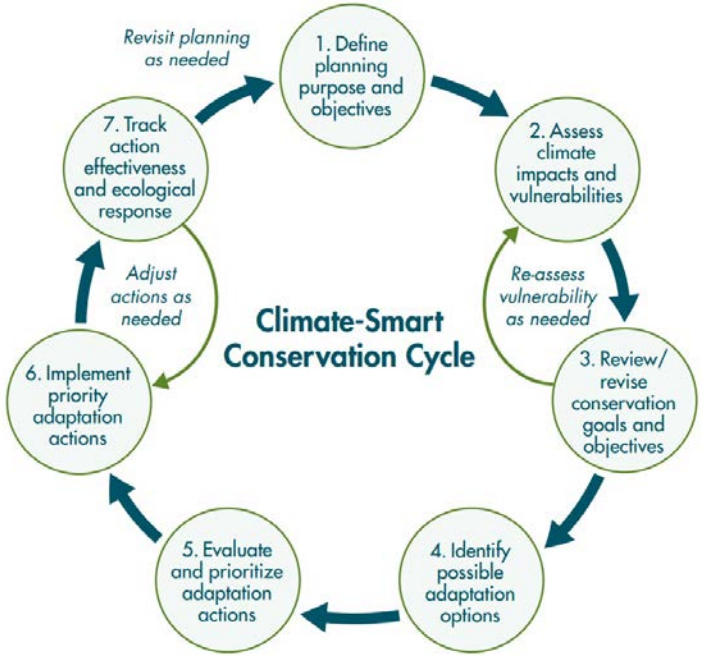
USFS Adaptation Workbook (2012, 2016)



Adaptation for Conservation Targets (ACT) Framework (2012)



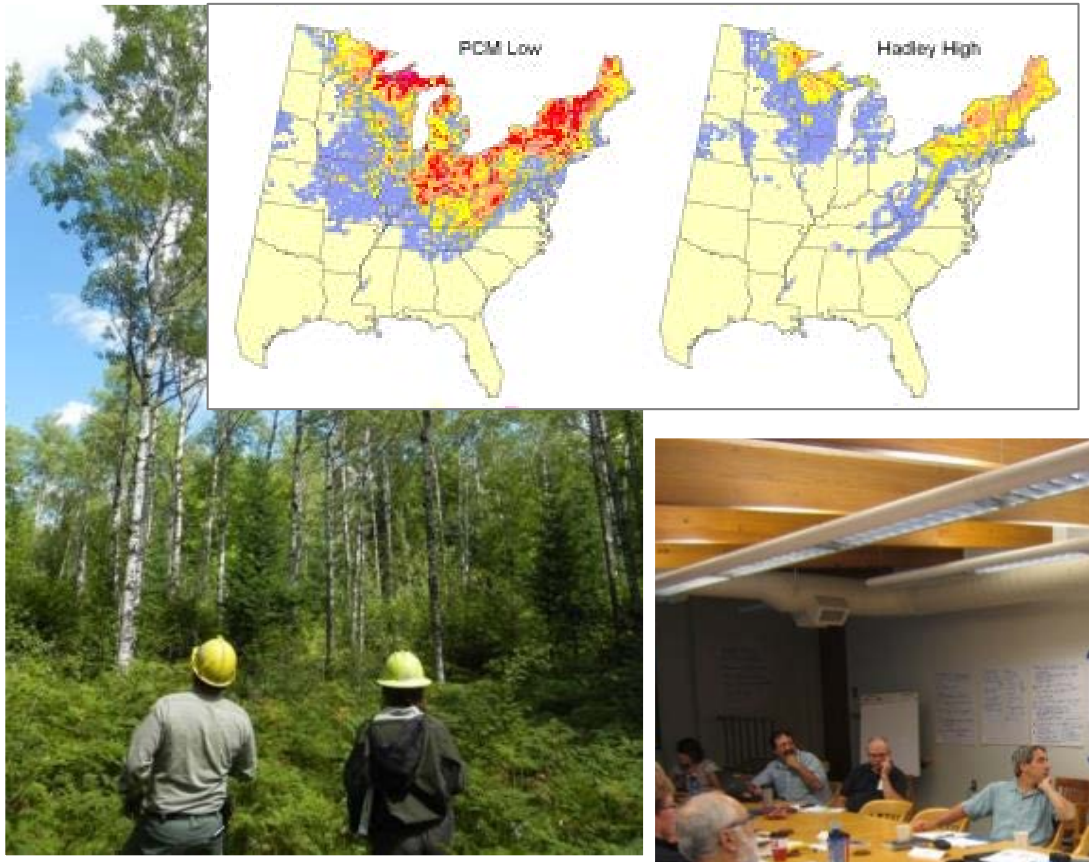
NWF Climate-Smart Conservation Cycle (2014)

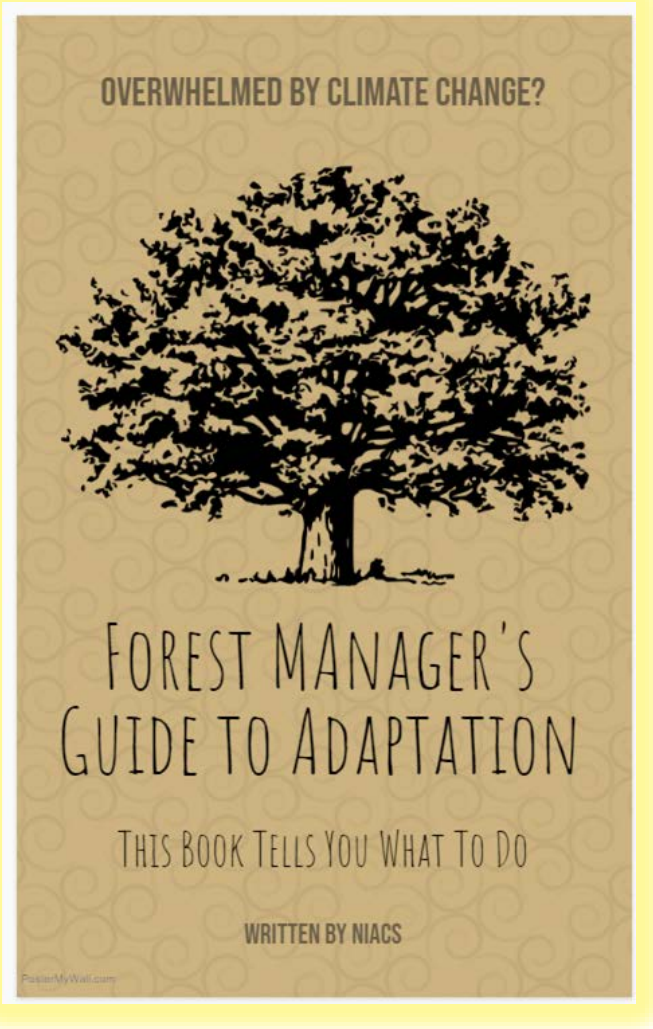


… a few examples

Getting from Goals to Action

There is no guide.





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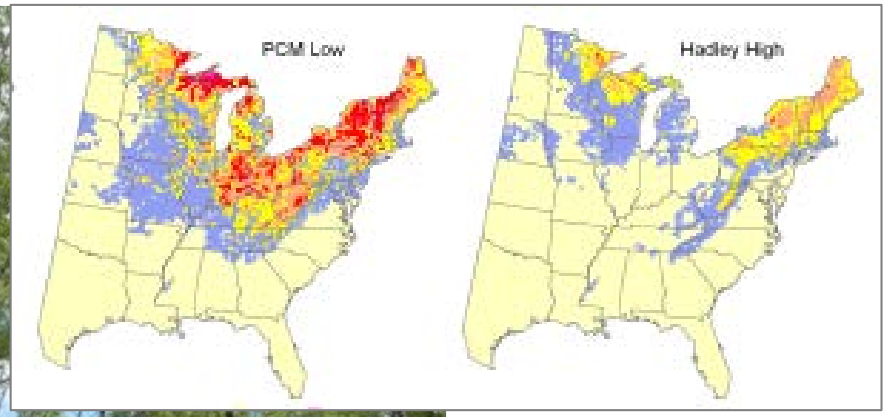
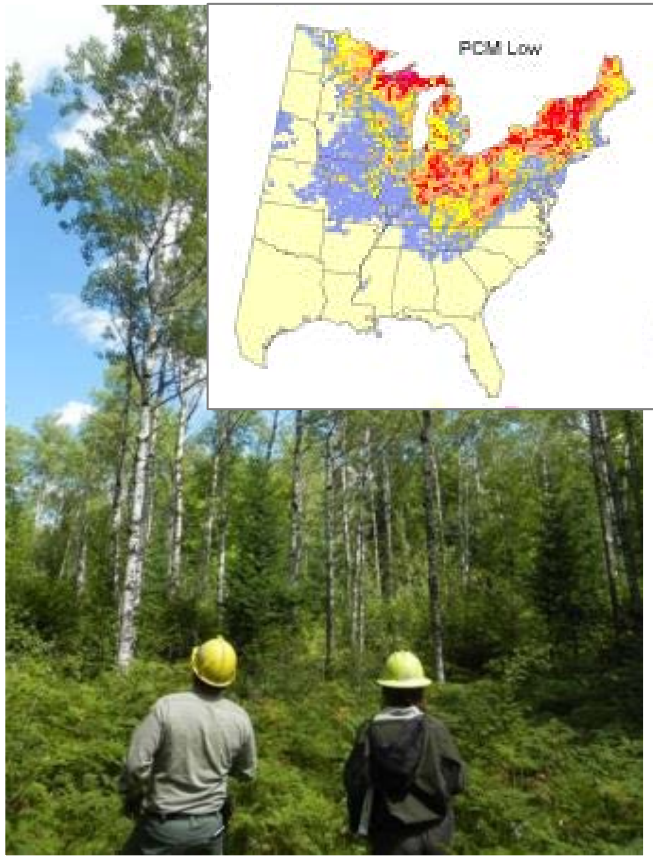




If you want a single “answer” for how to respond to climate change, it’s

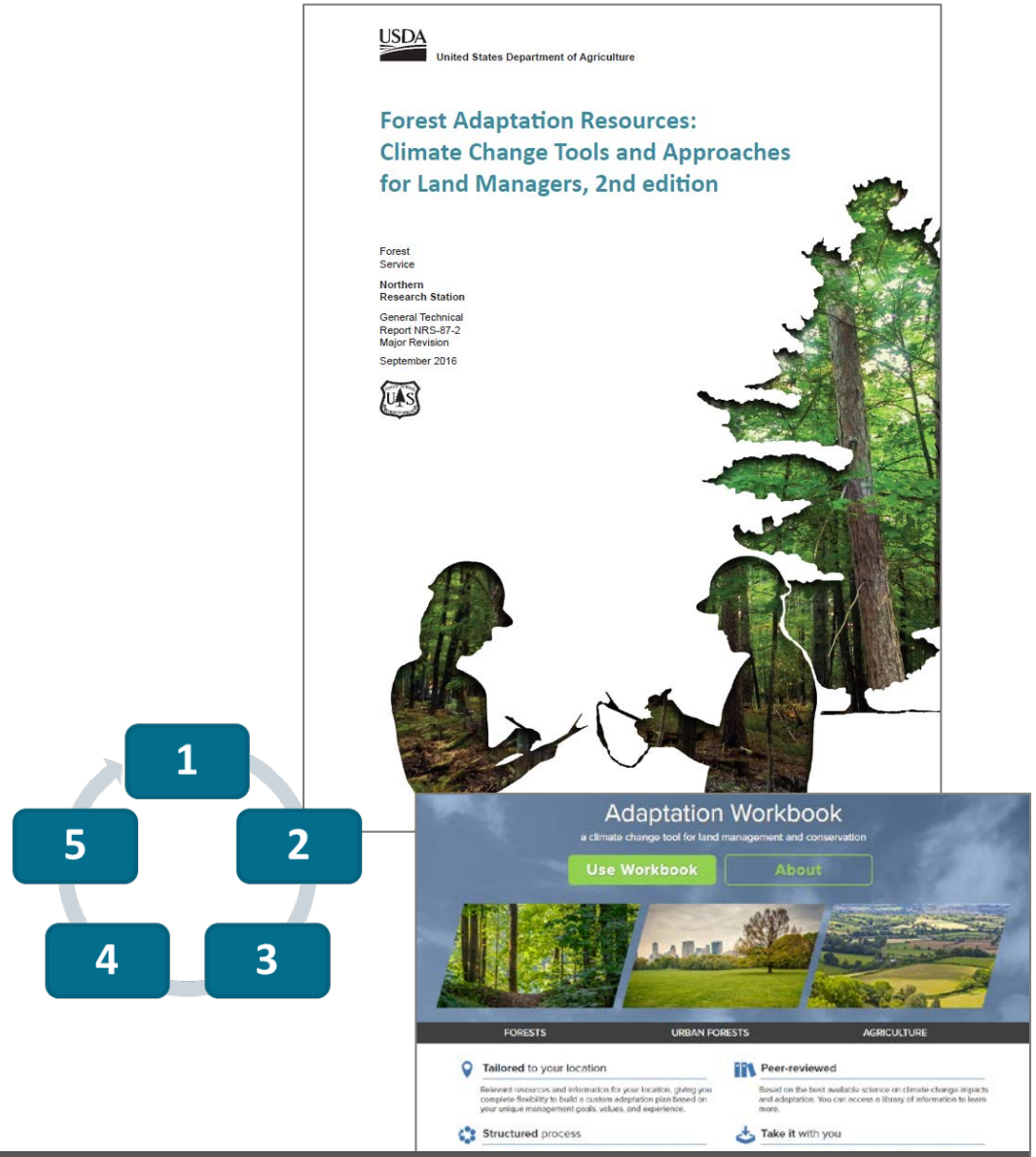
“It depends”

It depends on **where** you are working and **what** you’re trying to achieve.

Adaptation Example!

Adaptation Workbook

- Adaptive management process decision-support tool
- Designed for a variety of land owners with diverse goals
- Works at project-level
- **Does not make recommendations**



forestadaptation.org/adaptation-workbook

Swanston et al. 2016 (2nd edition) www.nrs.fs.fed.us/pubs/52760

Adaptation Resources for Natural Resource Management

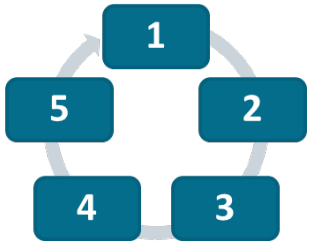
Expanding topics to include a variety of perspectives

- Forests
- Urban forests
- Agriculture
- Forested watersheds
- Tribes & cultural resources
- Carbon management
- **Non-forested Wetlands**
- Wildlife*
- Coastal habitats*
- Grasslands*

**Resources in development*

forestadaptation.org/strategies

Adaptation Workbook: Helps to connect the dots



A clear train of thought shows ***intentionality***

Management Goals & Objectives 1

2 Climate Change Impacts

3 Challenges & Opportunities

Adaptation strategies and approaches

4 Intent of Adaptation (Option)

4 Make Idea Specific (Strategy, Approach)

5 Monitoring

Action to Implement (Tactic)

Swanston and Janowiak 2016; www.nrs.fs.fed.us/pubs/52760

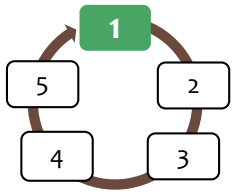
ForestAdaptation.org

Real-world Climate Adaptation Example:

Bohn Farms project

The Wisconsin DNR In Lieu Fee Wetland Mitigation Program,
Stantec consulting

forestadaptation.org/bohnfarms



Step 1: DEFINE area of interest, management goals and objectives, and time frames.

Bohn Farms Project

- Property (80 acres)
- Previously a family farm and used for agriculture with portions of the site extensively drained by ditches.

Rolling lake plain topography, mosaic of ephemeral wetlands and upland forest.

Vegetation:

- Annual weeds
- Degraded wet prairie/sedge meadow
- Remnant grassland and forest communities
- Ephemeral pond wetlands

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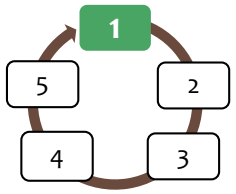
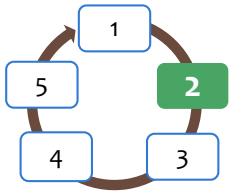


Step 1: DEFINE area of interest, management goals and objectives, and time frames.

Management Goals & Objectives

- Restore hydrologic functions on site
- Restore diverse native herbaceous wetland communities
- Provide diverse wildlife habitat
- Control invasive species *(reed canary grass, invasive Phragmites, non-native cat-tails, buckthorn)*



Step 2: ASSESS climate change impacts and vulnerabilities for the area of interest.

Site-specific climate change vulnerabilities

science2017.globalchange.gov

- **More extreme precipitation** may increase risks of erosion
- Increasing winter and spring precipitation may **reduce snowpack and alter recharge** that can affect early stages of veg. establishment
- **Dry and droughty conditions** may affect plant establishment. Particularly in formerly cropped areas with compromised soil structure & less organic matter
- **Invasive species** are expected to get worse over time
- **Changes in tree species habitat suitability** for upland forest and savanna on site

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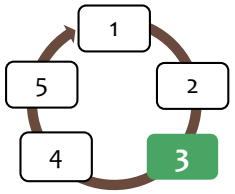
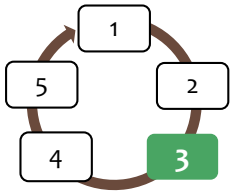


Step 3: EVALUATE management objectives given projected impacts and vulnerabilities.

Challenges to meeting mgmt. objectives

- Heavy rain could overwhelm water control structures, wash away seed, injure/uproot plants during vulnerable life stages, or introduce invasive plants.
- Drought could wipe out young plantings.
- Invasive species vigor due to longer growing seasons may become difficult to control
- Brush invasion may become a challenge to maintaining herbaceous species diversity



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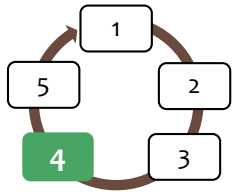
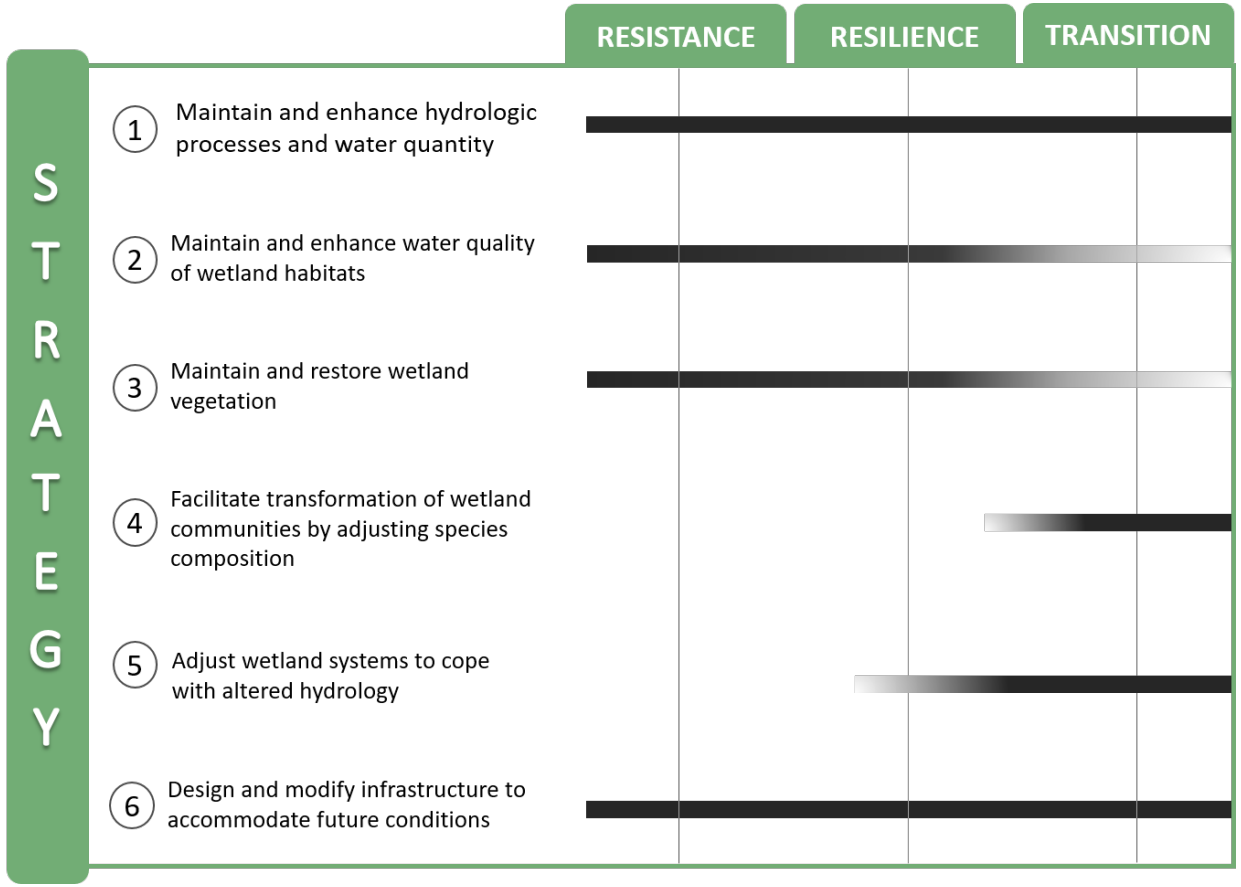
Opportunities to meeting mgmt. objectives

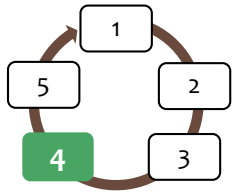
- Prairie species are intrinsically heat- and drought-tolerant. Wet prairie species will be more flexible to accommodate fluctuating water levels, and drought.
- Elevation variations onsite may allow the site to accommodate variable precipitation and hydrology.
- Oak trees on site can tolerate range of moisture regimes and may be adapted to future climate.



Step 4: IDENTIFY and adaptation approaches and tactics for implementation.



forestadaptation.org/wetland-menu



Step 4: IDENTIFY and adaptation approaches and tactics for implementation.

Adaptation Strategies	On-the-ground tactics
• Adjust wetland systems to cope with altered hydrology • Facilitate transformation of wetland communities by adjusting species composition • Maintain and restore wetland vegetation	• Restore site with a diverse species mix that can tolerate a broad range of moisture regimes (including inundation and drought) and clay-tolerant. • Allow plants to occupy spaces according to moisture and nutrient tolerances • Prescribed burns to restore savanna and wetland communities.
• Design and modify infrastructure to accommodate future conditions	• Design perimeter berms to withstand extreme storm events and retain water on site.

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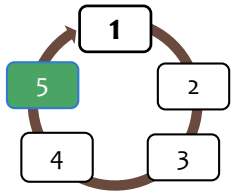

Step 5: : MONITOR and evaluate effectiveness of implemented actions.

Monitor with intent to adjust future management

1. Seedling diversity and success
2. Invasive species annual surveys
3. Acres of wetland comparing to baseline delineation pre-construction
4. Prescribed burn and post burn inspection
5. Monitoring shallow groundwater hydrology across site following construction

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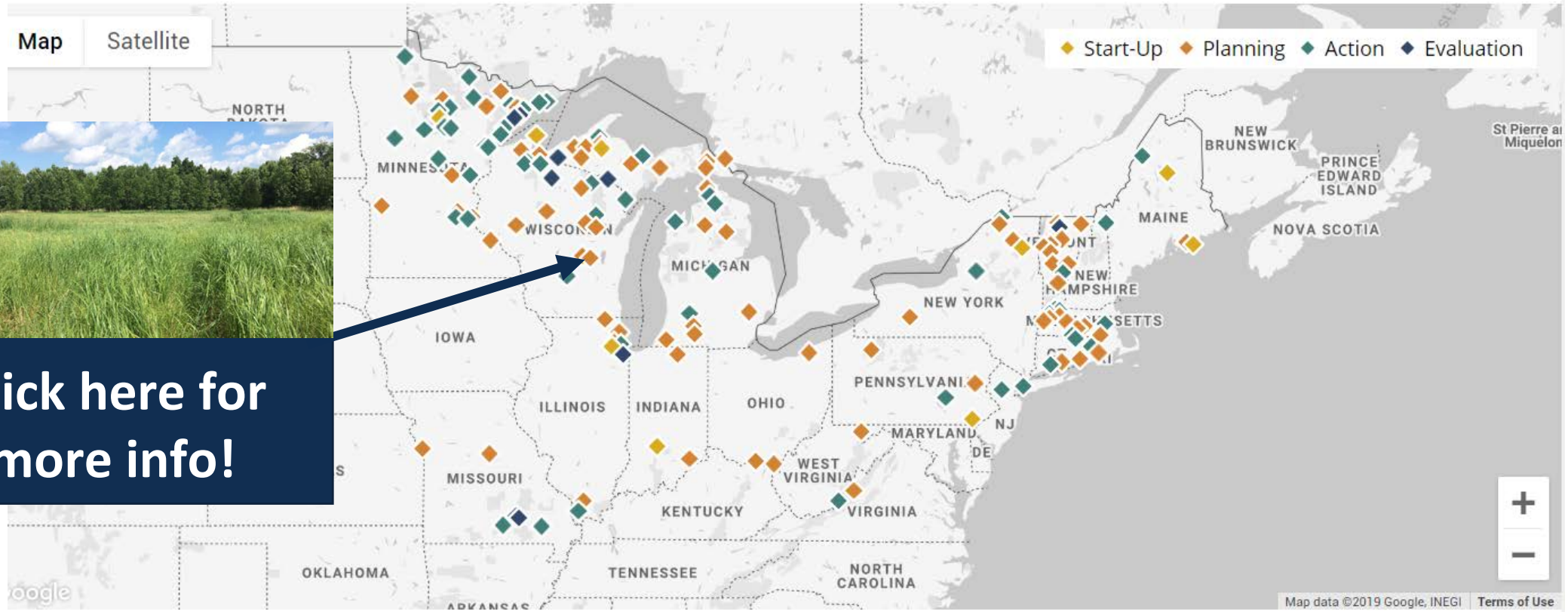
CLIMATE CHANGE
RESPONSE FRAMEWORK

Who we are | Assess | Adapt | Learn | Focus | Contact

Adaptation Demonstrations

Home » Adapt » Demonstrations

Click here for more info!



www.ForestAdaptation.org/demonstration-projects

Closing Thoughts…

Uncertainty is the new certainty

Don't wait for a shiny new tool – your judgement is still the best tool!

Same job, new challenges

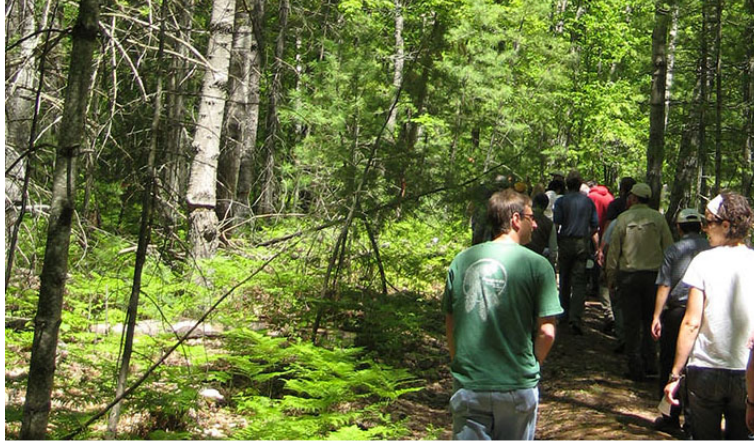
Similar stressors, but new patterns and agents

Adapt based on values and risk tolerance

Think about place and objectives within the context of risk and values

Find a planning process that works for you

…Then use it to get the job done.



Thank you!

Danielle Shannon
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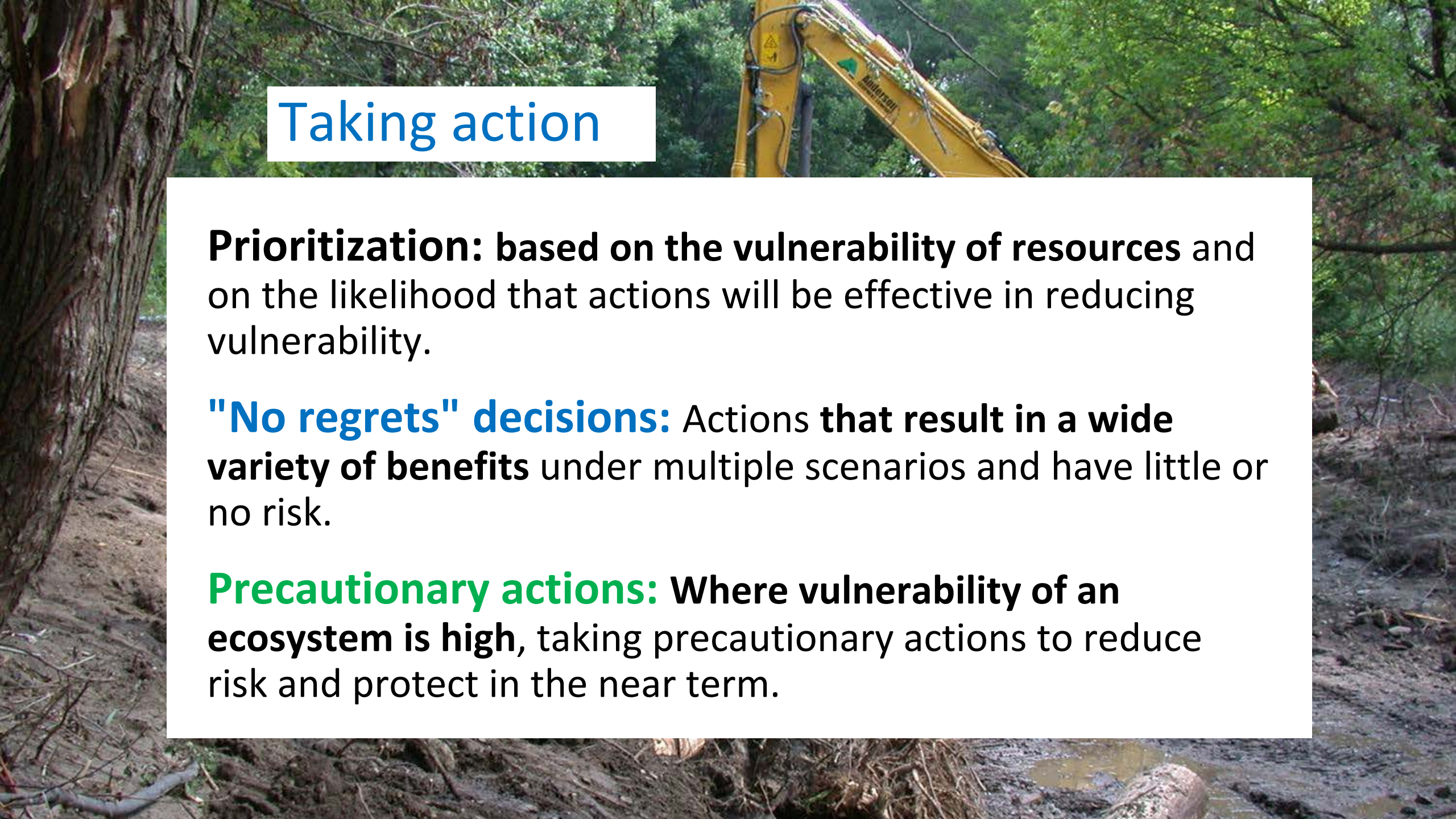


Taking action

Prioritization: based on the vulnerability of resources and on the likelihood that actions will be effective in reducing vulnerability.

"No regrets" decisions: Actions **that result in a wide variety of benefits** under multiple scenarios and have little or no risk.

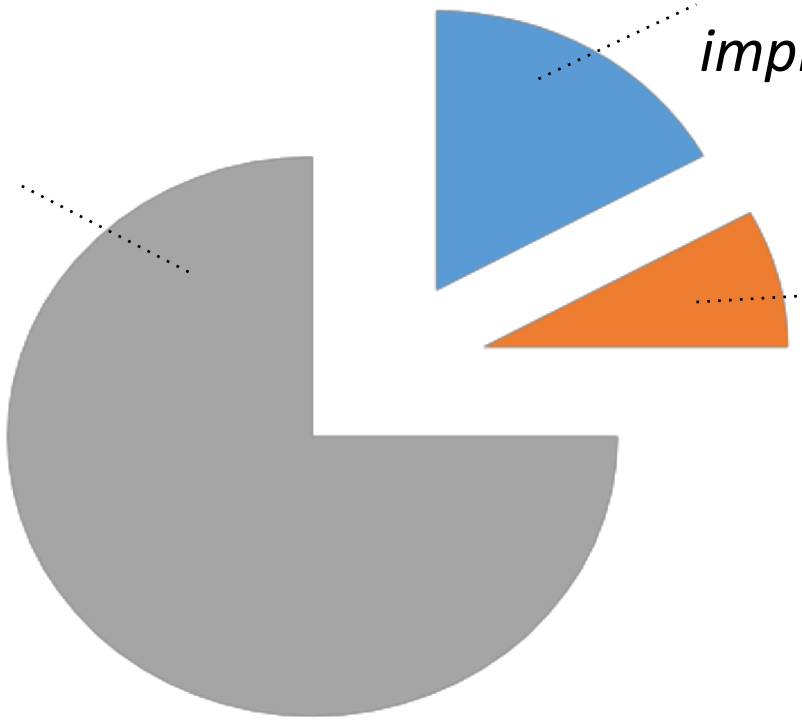
Precautionary actions: Where vulnerability of an ecosystem is high, taking precautionary actions to reduce risk and protect in the near term.

Adaptation: The Real Story*

Small "tweaks" *that improve effectiveness*

Same actions– *climate change just makes them that much more important*

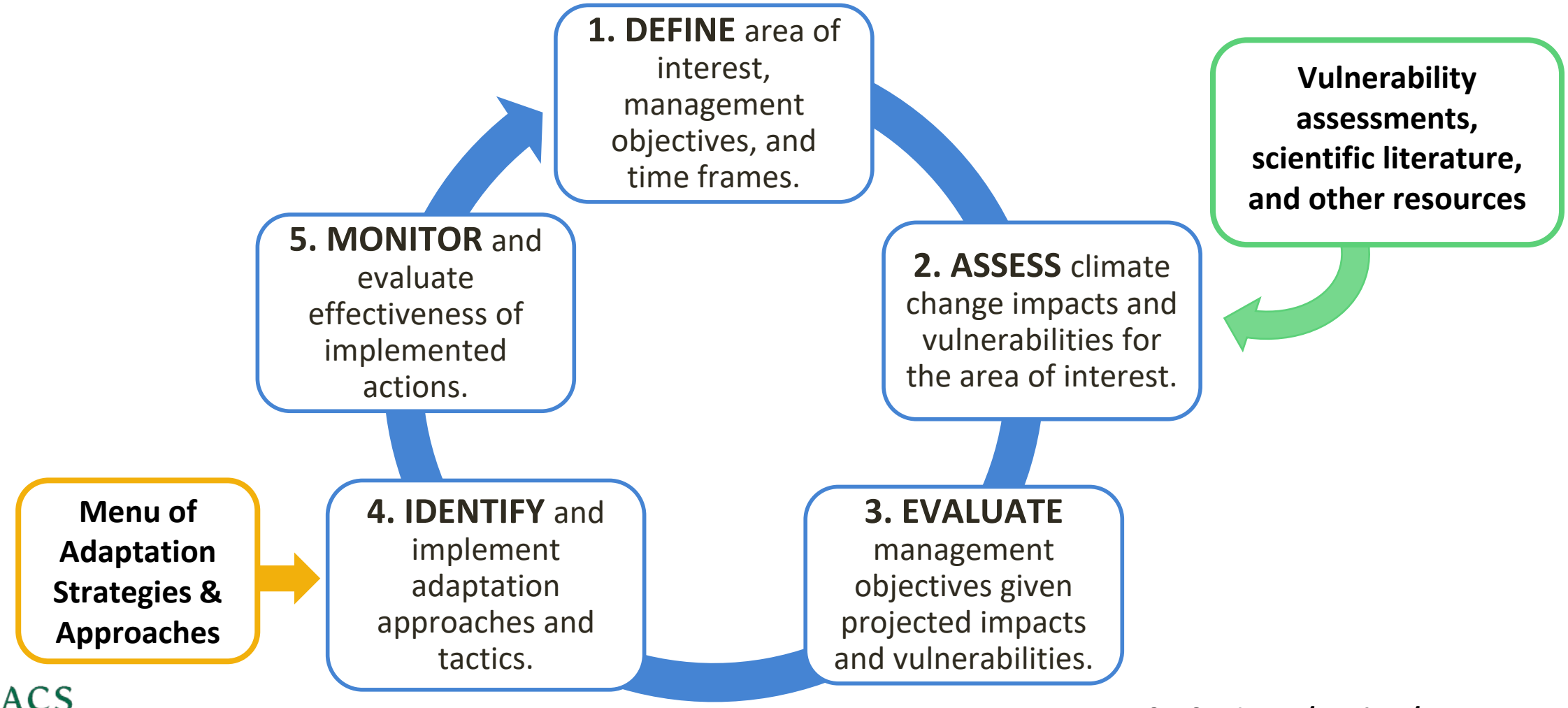
New & different *actions to consider, even some that may seem* ***wild & crazy***



**individual results will vary*

Adaptation Workbook: Decision-support tool

Provides "**structured flexibility**"

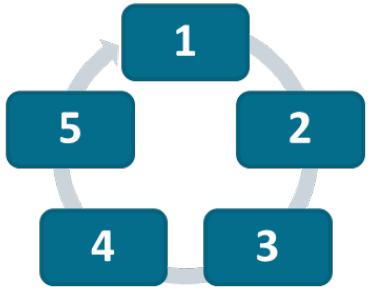


NIACS
Northern Institute of Applied Climate Science

www.nrs.fs.fed.us/pubs/52760

Adaptation Workbook Process

Structured process to identify adaptation actions



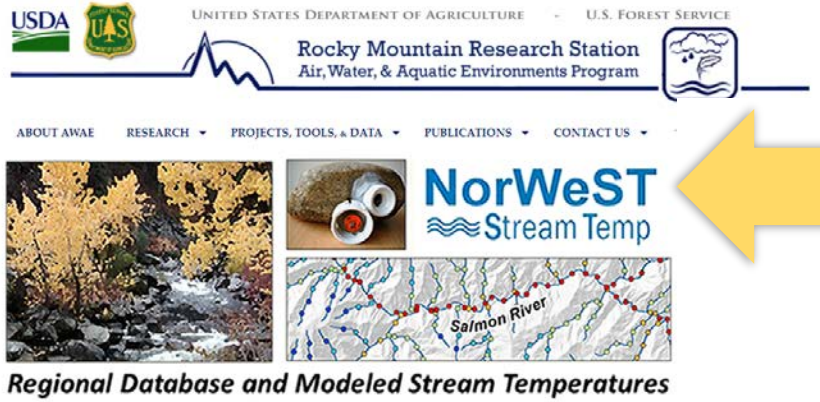
Step 1 Worksheet

Area of Interest/ Location	Ecosystem Type(s)	Management Goals	Management Objectives	Time Frames

Step 4 Worksheet

Adaptation Actions			Benefits	Drawbacks/ Barriers	Recommend Tactic?
Strategy/Approach	Tactic	Time Frame			

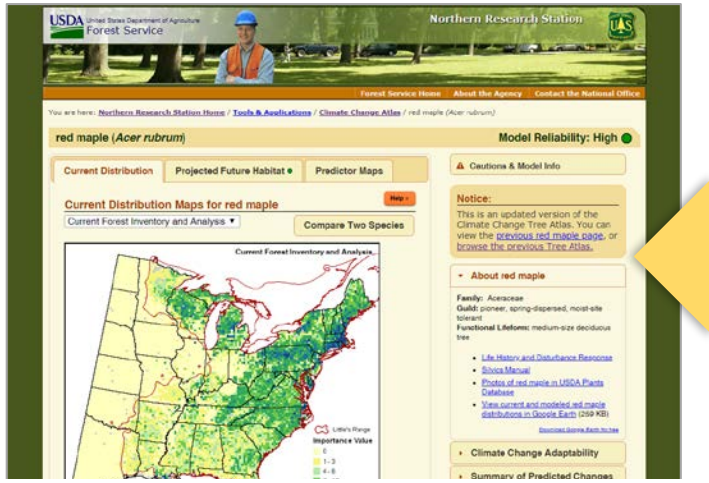
Tools and Data: Regional examples



Regional Database and Modeled Stream Temperatures

Western example:

NorWeST – Stream temperature database for >20,000 unique stream sites and modeled stream temperature scenarios for >1,000,000 km of streams in the western United States. USDA Forest Service. https://www.fs.fed.us/rm/boise/AWAE/projects/NorWeST.html



USDA Forest Service Climate Change Atlas
www.fs.fed.us/nrs/atlas

Eastern example:

Climate Change Atlas - Documents the current and possible future distribution of **134 tree species** and **147 bird species** in the eastern United States under climate change. USDA Forest Service. www.fs.fed.us/nrs/atlas